REMARKS

Status of the Claims

Claims 1 – 36 remain pending in the application, Claims 1 and 29 having been amended to clarify the claimed subject matter over the cited art and Claim 22 having been amended to correct a grammatical error.

Brief Summary of Telephone Interview

On June 19, 2006, applicants' attorney discussed the current Office Action with Examiner Ware during a telephone interview. Applicants' attorney appreciates Examiner Ware's willingness to explain her position in applying the references when rejecting applicants' claims, and her participation in the telephone interview to move the prosecution of the case forward.

During the discussion, applicants' attorney asked Examiner Ware to provide clarification regarding the Fukuda reference by pointing out where she believes Fukuda teaches applicants' step (a) of independent Claim 1, which recites "implementing a two–dimensional transform of the signal, producing a transform matrix having modulation frequency as one dimension" and more specifically, explaining where she believes "modulation frequency" is disclosed by Fukuda. In addition to the citations provided in the Office Action, Examiner Ware directed applicants' attorney's attention to lines 57 through the end of column 1 of Fukuda and pointed out that she believes Fukuda's "respective space frequency distributions" as disclosed in column 1, lines 41-42 are equivalent to applicants' modulation frequency.

Applicants' attorney asked Examiner Ware to provide clarification regarding the Fukuda reference by explaining where she believes Fukuda teaches applicants' step (a) of independent Claim 1 that recites "reducing a dynamic range of the signal." Applicant's attorney pointed out that the Examiner's citation to column 2, lines 25-28, indeed indicates that Fukuda discloses "reduces the volume of data" but there does not appear any justification for determining that Fukuda teaches reducing the volume of data is equivalent to reducing the dynamic range of the signal. Examiner Ware maintained that she perceives Fukuda as teaching this step.

Applicants' attorney also requested clarification from Examiner Ware as to where she believes the references disclose the steps of applicants' independent Claim 29. With respect to step (a), Examiner Ware indicated that she will perform another search to determine if other references may teach this step. With respect to step (b), determining a magnitude matrix and a phase matrix for the data, Examiner Ware indicated that this step is inherent in DCT as disclosed by Fukuda. With respect to step (c), modeling the

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magnitude matrix, Examiner Ware indicated that the step of modeling the magnitude matrix to enable working with one part (as opposed to the full signal) is equivalent to reducing the dynamic range of the signal as recited by applicants in Claim 1, step (b), so her citation to her rejection of step (b) of independent Claim 1 also applies to step (c) of independent Claim 29. With respect to step (d), quantizing the magnitude matrix and the phase matrix, Examiner Ware indicated that a transform as recited in applicants' Claim 1 step (c) will automatically include these parts. With respect to step (e), Examiner Ware indicated that her citation to her rejection of step (d) of independent Claim 1 also applies to this step.

Applicants' attorney would like to again thank Examiner Ware for her time and willingness to discuss these issues during the telephone interview.

Allowable Subject Matter

The Examiner has allowed Claims 16 through 28. The Examiner has indicated that the claims are allowable because the prior art references show similar methods but fail to teach what is recited in Claims 16 and 22 in regard to "determining an inverse quantized mean spectral density using the quantized mean spectral density; and driving bit allocations from the inverse quantized mean spectral density using a perceptual model." Prior art references also fail to teach in the recitation of Claim 27, "inverse quantizing the magnitude matrix and the phase matrix; adding the template models to the inverse quantized magnitude matrix, said inverse quantized phase matrix and a result produced by thus adding comprising a two dimensional transform; inverting the two dimensional transform; and performing post processing to yield a pulse code modulated signal corresponding to the perceptual signal."

The Examiner has objected to Claims 6 through 11 and 14 through 15 as being dependent upon a rejected base claim but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Prior art references show similar methods but fail to teach "the step of inverse quantizing the weighting factors to produce inverse quantized weighting factors" as recited in Claim 6. The prior art references fail to teach as recited in Claim 7, "preparing the mean spectral density function for quantization using the inverse quantized weighting factors and quantizing the means spectral density function thus prepared, producing a quantized mean spectral density function." The prior art references also fail to teach "the quantized mean spectral density function is also encoded into the data packets" as recited in Claim 8 and "producing an inverse quantized mean spectral density function" as recited in Claim 9. The prior art references also fail to teach "processing the inverse quantized mean spectral density function with a perceptual model to produce bit allocations used for encoding the data

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packets" as recited in Claim 10. Also, as recited in Claim 11, none of the prior art references teach "quantizing the phase matrix and the magnitude matrix using a number of bits determined by the perceptual model." The prior art references fail to teach "(a) transforming even numbered window sequences by discrete cosine transform to form an even transform sequence; (b) transforming odd-numbered window sequences by discrete sine transform to form an odd transform sequence; and (c) forming an orthogonal complex pair by combining the even transform sequence with the odd transform sequence" as recited in Claim 14. The prior art references fail to teach the recitation in Claim 15 of "applying a second transform to the orthogonal complex pair." However, applicants decline to rewrite these dependent claims in independent form because, for the reasons outlined below, applicants believe that the independent claims are patentably distinguishable over the cited art.

<u>Claims Rejected Under 35 U.S.C. § 103(a)</u>

Claims 1-5, 12-13, and 29-36 are rejected under 35 U.S.C. § 103 as being unpatentable over Fukuda et al., U.S. Patent No. 5,303,058 ("Fukuda") further in view of Dent, U.S. Patent No. 5,831,977 (hereinafter referred to as "Dent"). The Examiner indicates that Fukuda does not disclose applicants' step (d), but asserts that Dent does. The Examiner asserts that it would have been obvious to one of ordinary skill in the art to modify Fukuda to incorporate producing data packets in which the coefficients that have been selected are encoded based upon a desired order of the coefficients, with coefficients that are more perceptually relevant being used first to fill each data packet and coefficients that are less perceptually relevant being handled in one of the following ways (i) discarded once an available space in each data packet that is to be stored or transmitted has been filled with the coefficients that are more peceptually relevant; and (ii) disposed last within each data packet, so that the coefficients that are less perceptually relevant can subsequently be truncated from the data packet in order to allow the addition of redundancy (Dent, column 6, lines 6-10). Applicants respectfully disagree.

In the interest of reducing the complexity of the issues for the Examiner to consider in this response, the following discussion focuses on amended independent Claims 1 and 29. The patentability of each remaining dependent claim is not necessarily separately addressed in detail. However, applicants' decision not to discuss the differences between the cited art and each dependent claim should not be considered as an admission that applicants concur with the Examiner's conclusion that these dependent claims are not patentable over the disclosure in the cited reference. Similarly, applicants' decision not to discuss differences between the prior art and every claim element, or every comment made by the Examiner, should

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not be considered as an admission that applicants concur with the Examiner's interpretation and assertions regarding those claims. Indeed, applicants believe that all of the dependent claims patentably distinguish over the references cited. Moreover, a specific traverse of the rejection of each dependent claim is not required, since dependent claims are patentable for at least the same reasons as the independent claims from which the dependent claims ultimately depend.

Patentability of Independent Claim 1

Significant differences exists between the cited art and the subject matter of applicants' independent Claim 1, because the cited art does not teach or suggest modulation frequency, reducing a dynamic range of the signal and producing data packets that include encoded coefficients that have been selected based upon a desired order of the coefficients.

Claim Recitation Of "Modulation Frequency"

In its entirety, applicants' step (a) recites "implementing a two-dimensional transform of the signal, producing a transform matrix having modulation frequency as one dimension*, wherein said one dimension is a spectral representation of a time variability of a spectra of the signal*." The Examiner has asserted that Fukuda teaches this step and cites column 1, lines 38-45 and column 2, lines 3-14 of Fukuda. In addition, during the interview as described above, applicants' attorney's attention was also directed to column 1, lines 57 to the end of the column. More specifically, the Examiner indicated that Fukuda's space frequency is equivalent to modulation frequency. Applicants respectfully disagree. Because modulation dimension is very distinct from a spatial dimension, applicants have amended step (a) to clarify that the dimension represented by modulation frequency is a spectral representation of a time variability of a spectra of the signal. This definition for clarification purposes is based in part on a reference authored by S. Greenberg and B.E.D. Kingsbury entitled "The modulation spectrogram, in pursuit of an invariant representation of speech," 1997 IEEE International Conference on Acoustics, Speech, and Signal Processing, ICASSP.

Claim Recitation Of "Reducing A Dynamic Range Of The Signal"

In its entirety, step (b) recites "reducing a dynamic range of the signal." For example, applicants' disclosure recites:

> The first perceptual model is used to compute accurate weighting factors from the MSD function coefficients. The weighting factors are later used to whiten the MSD function (analogous to employing a whitening filter) and also to shape the noise associated with MSD quantization into unperceivable areas of the frequency spectrum. Thus, *the weighting factors reduce the dynamic range*. Preferably, approximately 25 weighting factors are produced. A simplified approach would be to extract peak values of the MSD

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> function coefficients from frequency groups approximately representing the critical band structure of the human auditory system. The peak values would be simple scale factors that whiten the spectral energy, but do not shape the noise into unperceivable areas of the frequency spectrum. (Emphasis added, applicants' specification, page 8, lines 10-20.)

In the italic font portion above, applicants disclose how weighting factors are used to whiten the MSD function and to shape the noise associated with MSD quantization and thus, reduce the dynamic range of the signal. The step of reducing the dynamic range of an audio signal might, for example, decrease the loudness range of the signal in terms of dB. In general, reducing the dynamic range of a signal reduces the magnitude of the difference between the maximum level of the signal and the minimum level of the signal.

In contrast, Fukuda does NOT teach or suggest reducing the dynamic range of the signal, because Fukuda instead discloses reducing the volume of data. Reducing the volume of the data would reduce the number of bytes of data or the number of packets of data – not the magnitude of the signal. The Examiner asserts that Fukuda teaches reducing a dynamic range of the signal and in support of her citation she cites column 2, lines 25-28 that is reproduced below:

> By converting the elements of the quantized coefficient matrix D.sub.QU into runs and indices, the coder 31 *reduces the volume of data* necessary for expressing the quantized coefficient matrix D.sub.QU. (Fukuda, column 2, lines 25-28.)

However, what Fukuda is teaching is reduction in the volume of data. But reduction in the volume of data is NOT equivalent to reducing a dynamic range of the signal. Thus, Fukuda does NOT teach reducing a dynamic range of the signal.

<u>Claim Recitation Of "Data Packets"</u>

A portion of applicants' step (d) in Claim 1 recites:

> (d) …coefficients that are less perceptually relevant being handled in one of the following ways:
>
> (i) discarded once an available space in each data packet that is to be stored or transmitted has been filled with the coefficients that are more perceptually relevant; and
>
> (ii) disposed last within each data packet, so that the coefficients that are less perceptually relevant can subsequently be truncated from the data packet.

For clarification, applicants' disclosure states:

> To ensure that the target rate is met, the data from the quantized phase matrix and encoded magnitude matrix are reordered at a step 130, into the data packet bit stream with respect to their perceptual relevance. Specifically, low modulation frequencies and low base-transform frequencies are inserted into the data packet bit stream first. High

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> modulation frequencies and high base-transform frequencies are perceptually less important. <u>If need be, the high frequencies can be removed without unacceptably adverse consequences. For example, for low data rates, the phase information (i.e., high base-transform frequencies) above 5 kHz are not transmitted. Instead the receiving decoder replaces the phase information with randomized phase.</u> This process does not lead to significant perceptual loss, as shown by empirical tests conducted with 25 participants. (Emphasis added, applicants' specification, page 9, line 33 – page 10, line 6.)
>
> Because the perceptually important data is placed at the beginning of the data packet, *transmission of the information in a single packet can simply be terminated as necessary to accommodate the target data rate, without causing annoying perceptual losses. For example, if a communication channel data rate capacity is less than the encoded data rate, the data packet is simply truncated to accommodate the channel limitations.* This progressive aspect is fundamental to the scalability of the invention. (Emphasis added, applicants' specification, page 10, lines 7-12.)

In the underlined portion of the above quote, applicants describe how high frequencies can be removed from the data packet bit streams if it is desirable not to transmit the phase information for low data rates. Thus, with respect to applicants' step (d)(i), applicants illustrate how coefficients that are less perceptually relevant can be discarded once an available space in each data packet is filled with the more perceptually relevant coefficients such as the low modulation frequencies and low base-transform frequencies.

In the italicized portion of the above quote, applicants describe how, for example, a data packet can be truncated to accommodate the channel limitations if a communication channel data rate capacity is less than the encoded data rate. So, transmission of information can be terminated as necessary in the single packet. Thus, with respect to applicants' step (d)(ii), applicants illustrate that, since the less perceptually relevant coefficients are disposed last within each data packet, they can be truncated from the data packet.

In contrast, Dent does NOT teach that the less perceptually relevant coefficients are either discarded or disposed last within each data packet so that the coefficients can be truncated. Instead, Dent teaches that less important symbols remain and are simply transferred from one encoder to another encoder. The Examiner asserts that Dent teaches applicants' recited steps and in support of her assertion, cites column 6, lines 6-39, which is reproduced below:

> The bitrate from the speech encoder may be increased again by the use of error correction encoding. Most redundancy is added to protect the most perceptually important bits while the least perceptually important bits may not be coded at all. Such coding, if any, is considered to be part of block 11 in FIG. 1. The resulting encoded digital speech from block 11 is formed into multi-bit symbols for spread-spectrum encoding in block 13. For example, 7-bit blocks can be formed and each of the 128 possible 7-bit patterns is

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> represented by one of 128 orthogonal Walsh-Hadamard codes, thus expanding the bitrate further by a factor of 128/7. When such block-orthogonal spread-spectrum symbol coding is employed, a preferred form of error correction coding within speech encoder 11 is Reed-Solomon coding, which is adapted to code multi-bit symbols. The combination of Reed-Solomon coding and Walsh-Hadamard coding can be done in a variety of ways to produce unequal coding for the most and least perceptually significant bits. For example, a Reed-Solomon code constructed on a GF2**7 can code a block of **7-bit important symbols** to produce an RS-coded block containing a greater number of symbols. A "Galois Field" or GF is the set of all integers from 0 to some maximum that is a closed set under some modulo combinatorial operations. A GF2**7 (two to the power of seven or GF2.sup.7) means all integers from 0 to 127, i.e., all 7-bit binary codes. If two of these are combined by 7-bit wide XOR (modulo-2 addition) an other 7-bit value in the set results, so <u>the set is "closed" under the combinatorial operation "XOR"</u>. The *remaining less important symbols* can be formed into 7-bit blocks but not RS coded. The RS-coded and the non-RS-coded 7-bit symbols are then output from the encoder 11 to the Walsh-Hadamard encoder 13, the bit-to-symbol formation 12 having already been performed inside the encoder 11 in this case, at least for the RS-coded symbols. (Emphasis added, Dent, column 6, lines 6-39.)

If the Examiner is equating Dent's "remaining less important symbols" and "closed set" as highlighted above, as being equivalent to applicants' claim recitation of "coefficients that are less perceptually relevant," and a data packet that has been filled with coefficients, respectively, it is then apparent that Dent's remaining less important symbols are neither discarded as recited in applicants' step (d)(i), nor disposed last as recited in applicants' step (d)(ii). In the coding method described in column 6, lines 6-39 of Dent, he discloses how the remaining less important symbols are formed into 7-bit blocks but not RS coded. (Specifically, see Dent, column 6, lines 34-35.) These non-RS-coded 7-bit symbols are output from the encoder 11 to encoder 13. (Dent, column 6, lines 35-37.) In an alternative unequal coding method, Dent describes how two bits of lesser importance are added to each 5-bit RS symbol to obtain 7-bit symbols, which are submitted to encoder 13. (Dent, column 6, lines 40-45.) Thus, there is no teaching by Dent of discarding coefficients, since Dent's less important symbols remain to be formed into 7-bit blocks or are added to each 5-bit RS symbol and are then sent to encoder 13.

In addition, there is no teaching in Dent of disposing the less perceptually relevant coefficients last within each data packet, since Dent's set is closed, and the remaining less important symbols are not disposed last within each data packets but instead, are output from the encoder 11 to encoder 13. (Dent, column 6, lines 33-35.) In the alternative unequal coding method, although Dent discloses that the lesser important bits are added to each 5-bit RS symbol (Dent, column 6, lines 44-45), there is no teaching that these coefficients can be truncated from the data packet.

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Accordingly, it is apparent that the cited art does not teach or suggest all that is recited in applicant's independent Claim 1. For the reasons noted above, the rejection of independent Claim 1 under 35 U.S.C. § 103(a) over the cited art should be withdrawn.

Claims 2-15 ultimately depend from independent Claim 1. Because dependent claims inherently include all of the steps or elements of the independent claim from which the dependent claims ultimately depend, dependent Claims 2-15 are patentable for at least the same reasons discussed above with regard to independent Claim 1. Accordingly, the rejection of dependent Claims 2-15 under 35 U.S.C. § 103(a) over the cited art should be withdrawn.

<u>Patentability of Independent Claim 29</u>

Significant differences exist between the cited art and recitation of applicants' independent Claim 29, because the cited art does not teach or suggest determining a mean spectral density function of the data for inclusion in the data packets, or perceptually ordering the data in the data packets to ensure that an available capacity of the data packets is filled. Independent Claim 29 is directed towards a method for perceptually ordering data within data packets that are sized as a function of either an available storage or an available data transmission bandwidth.

Applicants' step (a) recites "determining a mean spectral density function of the data for inclusion in the data packets." During the telephone interview, Examiner Ware indicated that she will perform another search to determine if prior art can be found that discloses this step. The currently cited art does not do so.

Applicants' step (e) recites:

> perceptually ordering the data included in the data packets, so that perceptually more important data are inserted first into each data packet, and perceptually less important data are inserted successively thereafter to ensure that an available capacity of the data packets is filled with perceptually more important data in preference to the perceptually less important data.

For example, applicants' disclosure states:

> PERCEPTUAL ORDERING OF DATA AND PROGRESSIVE SCALABILITY
>
> During the coding process, it will be recalled that the MSD is coded and placed on the data stream. Also during the encoding process, the magnitude matrix is normalized, modeled, quantized, and Huffman coded, and the phase matrix is quantized. *The final step prior to the transmission of the encoded data is perceptual ordering*, which allows for fine grain scalability. The perceptual ordering is preferably done adaptively, such that the most important information is transmitted to the decoder when the data bandwidth is limited. *An example of perceptual ordering is to put the highest priority elements of the magnitude and phase matrix into the bit stream packet first, where low modulation frequencies (beyond the*

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> *MSD) have priority over higher modulation frequencies*. (Emphasis added, applicants' specification, page 15, lines 16-26.)
>
> The ordered data are packed into the bit stream packet <u>such that when the maximum allowable bit count has been reached, transmission of the frame terminates</u> and the transmission of the next frame begins. (Emphasis added, applicants' specification, page 15, lines 27-29.)

In the italicized portion above, applicants disclose how perceptual ordering is the final step prior to transmission of the encoded data. An example of this step is to put the highest priority elements of the magnitude and phase matrix into the bit stream packet first. Low modulation frequencies have priority over higher modulation frequencies. Thus, applicants illustrate perceptually ordering the data so that perceptually more important data such as low modulation frequencies is inserted first into each data packet and perceptually less important data such as higher modulation frequencies are inserted after the highest priority elements are inserted. In this manner, the ordered data are packed into the bit stream packet (such that perceptually less important data are inserted successively thereafter) and when the *maximum allowable bit count* has been reached, transmission of the frame terminates.

In contrast, Dent does NOT teach or suggest that perceptually more important data are inserted first into each data packet and perceptually less important data are inserted successively thereafter to ensure that *an available capacity of the data packets is filled*, because Dent teaches either closing a set under some modulo combinatorial operations or simply forming a larger block. If the Examiner is equating Dent's "remaining less important symbols" and "7-bit important symbols" with applicants' claim recitation of "perceptually less important data," and "perceptually more important data," the rejection fails, because Dent teaches closing the set, but does not teach or suggest perceptual ordering to ensure that an available capacity of the data packets is filled with perceptually more important data in preference to the perceptually less important data. In the one coding method disclosed in column 6, lines 6-41, Dent discusses how the 7-bit important symbols are coded to produce an RS-coded block but then the set can be considered to be "closed." This approach is not the same as ensuring that an available capacity of the data packets is filled. Applicants data packets are sized as a function of either an available storage or an available data transmission bandwidth as recited in the preamble and as now recited in step (a) in the amended claim. In the alternative unequal coding method disclosed in column 6, lines 41-47, Dent simply discusses forming a *larger* block of RS-coded 5-bit symbols. Again, there is no teaching of an equivalent to applicants' data packets that are sized as a function of either an available storage or an available data transmission

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bandwidth. Dent simply forms larger blocks. Accordingly, it is apparent that the cited art does not teach or suggest all that is recited in applicants' independent Claim 29. For the reasons noted above, the rejection of independent Claim 29 under 35 U.S.C. § 103(a) over the cited art should be withdrawn.

Claims 30-36 ultimately depend from independent Claim 29. Because dependent claims inherently include all of the steps or elements of the independent claim from which the dependent claims ultimately depend, dependent Claims 30-36 are patentable for at least the same reasons discussed above with regard to independent Claim 29. Accordingly, the rejection of dependent Claims 30-36 under 35 U.S.C. § 103(a) over the cited art should be withdrawn.

In consideration of the remarks set forth above, all claims in the present application are patentable over the art of record. Since the application is in condition for allowance, the application should be passed to issue without further delay. Should any questions remain, the Examiner is invited to telephone applicants' attorney at the number set forth below.

Respectfully submitted,

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